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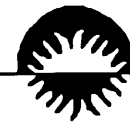

Combining Reading and Writing With Science to Enhance Content Area Achievement and Attitudes

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Reading through science is different because you are reading and learning science at the same time. And plain reading is boring because you do reading book and when the teacher says group two we have to go up to the reading table. And read for a half hour then she makes us do a reading work sheet about the story we read. And reading science is better because... the activities and experiments we did helped me understand science better.

A fifth-grade drop-out prevention student wrote the preceding reflection after participating in a research study investigating the effects of combining language arts with science on achievement and attitudes (Romance and Vitale, 1992; Romance, Vitale, and Bristor, 1992). Recognizing the need for improved reading comprehension, more efficient writing, and increased content knowledge, Romance, Vitale and Bristor conducted a five-year research project to study the effects of an integrated curriculum strategy on the achievement, attitudes, and self-confidence of fourth and fifth grade students.

The experimental science/reading students received in-depth instruction in science and reading including numerous opportunities for hands-on science, writing, and discussion of ideas and concepts. Teachers guided students in directed reading in the content area related specifically to the science concepts being learned. Teachers also used trade books and other print materials as well as visual technology materials such as cable television, videotapes, laser videodisks, filmstrips, and computers to access prior knowledge and augment background experiences to enhance comprehension of the science text.

Control students received their regular basal reading and science programs separately. The comparison groups were selected from schools whose demographics matched those of the experimental groups. All groups used the following standardized achievement tests: Metropolitan Achievement Test-Science subtest; Iowa Tests of Basic Skills-Reading subtest; and a 6-scale affective inventory which assessed attitude toward learning in science, self-confidence in learning science, attitude toward reading, self-confidence in reading, attitude toward learning science out of school, and attitude toward reading out of school. The covariate was the previous year's ITBS-Reading subtest.

During the first two years (1988-89 and 1989-90), science/reading students obtained significantly greater levels of achievement in both reading ($F\ [1,125] = 8.14$, $p < .01$) and science ($F\ [1,125] = 13.62$, $p < .001$) than students who received instruction through their regular basal reading and science programs separately. When drop-out prevention students were included during the third year (1990-91), the science/reading at-risk students in fifth grade significantly outperformed comparable control groups in science ($F\ [1,148] = 30.36$, $p < .001$) and reading ($F\ [1,161] = 7.16$, $p < .001$) achievement.

During the fourth year (1991-92) the research effort encompassed more school sites to include students whose abilities ranged from at-risk/below-average to average/above-average. Fourth and fifth grade students receiving the science/reading strategy displayed significantly greater performance in science ($F [1,438] = 52.79, p < .01$) and reading ($F [1,497] = 18.18, p < .01$). Throughout the study the science/reading students also displayed more positive attitudes and greater self-confidence ($p < .01$) toward science and reading. Data from the fifth year (1992-93) of the study are currently being analyzed. What follows are some examples of reading and writing activities conducted by some of the teachers participating in this study.

Science reading activities

Pre-reading strategies. Many experimental teachers used PReP, or the Pre-Reading Plan (Langer, 1981), to determine what students already knew about a topic and to help expand the knowledge of those students with limited backgrounds. Teachers simply wrote the science topic or concept on the board (for example, *weather*) and asked the students to say any words that came to mind. After students reflected on why they thought of those words or ideas, they refined and expanded their concepts. Graphic organizers help students visually construct relationships among words and concepts prior to reading the science texts (Pearson and Fielding, 1991). Teachers used semantic maps, story maps, organizational patterns, semantic feature analysis, Venn diagrams, K-W-L, imaging, and graphic aids such as photographs, tables, charts, margins, and boldfaced type (Gunning, 1992).

Hands-on activities usually preceded the textbook reading to promote concept understanding by providing common experiences for all students. These activities encouraged students to use operational definitions for understanding concepts rather than stale, meaningless dictionary responses.

Fifth grade students studying the respiratory system made models of lungs and diaphragms with plastic containers, balloons, and straws. They observed what happened to the lung when the diaphragm was pulled down, then up. Students also pressed on their chests lightly while taking deep breaths to feel their ribs and diaphragms working together to pull air into the lungs and to expel air from the lungs. After everyone obtained some prior knowledge through these activities, the class was ready to read the following from their science text (Shymansky, Romance, and Yore, 1988):

> *Another part of your body that helps you breathe is a sheet of muscle called the* diaphragm. *The diaphragm lies just below the lungs. In fact, it separates the chest cavity from the abdominal cavity. Look at the picture on this page. When the diaphragm relaxes, it moves up toward the lungs, so the air is pushed out. The diaphragm, therefore, acts like a pump (p. 272).*

Using their own words based on their own experiences gained through the activities, students were able to provide an operational definition of diaphragm which was more meaningful and useful than a memorized dictionary or text definition.

Reading/language arts objectives. Teachers in the experimental group referenced the district-wide skills-based curriculum objectives in reading/language arts to specific science activities and taught those objectives as they were naturally embedded within the science text and activities in place of workbooks and worksheets. Identifying the main idea, using context clues to determine word meanings, identifying cause and effect, punctuation, capitalization, and other reading/language arts skills were more relevant and motivating when conducted in the context of meaningful activities and purposeful reading.

Several teachers used QAR to help children put together several pieces of information from the reading or use their background experience plus that information to answer higher levels of questions such as inferencing and evaluating (Raphael, 1986). Other comprehension strategies included reciprocal teaching, retelling, text structure instruction, Directed Reading Activity, Directed Reading-Thinking Activity, and cloze (Gunning, 1992).

Teachers used words from the science textbook for spelling lists, often providing students with the opportunity to select some of the words to be included on the lists. Adults expressed amazement as these elementary students easily spelled out words such as *amoebae, chlorophyll, photosynthesis,* and *protozoan.*

Literature. Independent reading activities using trade books and other science print materials supported the science lesson. Some teachers began with basal stories correlated with the science topic being studied. Other teachers used special resources to connect literature to the science topic such as *Science Through Children's Literature: An Integrated Approach* (Butzow and Butzow, 1989) and a variety of published thematic units available.

The *Reading Rainbow* videos and the corresponding sourcebooks (Schweiger, 1988, 1991; 1992) were a popular resource for literature related to a science topic. After viewing the "Hill of Fire" *Reading Rainbow* video (Liggett, 1985) and browsing through the book (Lewis, 1971), the students in Eulalee Burke's at-risk fourth grade pretended to be on-the-scene reporters recounting the events surrounding the eruption of a volcano in Mexico. Children usually reluctant to write were excited about the assignment. One student

combined the background knowledge (facts concerning the event as well as vocabulary words such as *village* and *abandoned*) provided by the video and book with scientific concepts (how volcanoes are formed) from the science textbook:

> *On February 20th 1943 a farmer was plowing in Mexico. Then the plow got stuck in the earth crust and the earth began to shake. Then smoke came from the ground. A hill came up from the ground and shoting rocks from the ground. And the heat and the pressure formed a volcano. The volcano erupted and the volcano covered the vilige was destroyed. The people abanded their homes. No people were hurt but their homes were destroyed. Now 50 years later you can go see the volcano and the covered vilige.*

Afterward, children read their news reports before a video camera.

Science writing activities

Learning logs. Each student in the experimental classrooms had a learning log for science. The children used the logs in a variety of ways: to write predictions before an experiment, write observations during an experiment, write conclusions after the experiment, state what was learned after a lesson, describe favorite experiments, write summary paragraphs using main ideas and details discussed in class, and so on. One fifth-grade student in Connie Robinson's class wrote:

> *[November 6, 1991] My prediction was that the yellow balloon will not float. The reason why I thought the yellow balloon wasn't going to float because it was smaller than the rest of the balloons.*
>
> *The activity was placeing a yellow balloon in the water to see if it will float.*
>
> *The conclusion was that the yellow balloon did not float.*

(November 8, 1991) Today I learnd about density. I found out why one of the yellow balloons sanked. The reason why one yellow balloon sanked because one was more denser. One balloon had salt water in it. Salt makes water more dense and thats why one of the yellow balloons sanked.

Paraphrasing/summarizing science learning. Kim Perdue, a fourth grade science/reading teacher, directed her students to paraphrase what they had read about erosion. One student wrote the following:

Leveling the land. Rocks fall into a big valley. Gravity pulls down the rocks into the water and to the valley. If I put a nail into water it gets rusty and gets loose. If lime stone is put into a thunder storm it gets smaller. If you freeze milk the milk gets hard and pops open. And if you freeze water in a glass jar it does not get hard but it brakes and spills. A rock that have been wet it cracks. Enofe rock to make a mountain has been washed away. After it rains the rocks turn into mud.

After discussing the grouping of living things, Kim's students summarized what they had learned about various animal groups. One student summarized what was read about "Big Animals of Africa" (see Figure 1).

Applying science to real life. Making learning purposeful and meaningful creates interest as well as increases comprehension and retention. Kim Perdue's fourth grade students wrote several pieces concerning the application of what they had learned to their own lives and the world around them. In one assignment students wrote a "Diary of my Past" to help them understand a Geologic Time Table. Some amusing samples from one student are the following:

I hated milk when I was a baby and I hate it now. My mom said I had really thick and curly hair. And I was chubby. I was born on January 7, 1982.

When I was eight I had two teachers. Because Ms. Shecter was here so long she retired. An then we got Ms. Bruno. We had treats every Friday unless we got are name on the board. And I just moved into my new house.

Now I'm ten all grown up. Past all those baby stages. I'm in fourth grade living my own life. I just got to do one thing get taller.

Kim Perdue emphasized the relevance of science in the children's own lives. One of Kim's students wrote an "I'm no fool with electricity!" piece after studying electricity (see Figure 2).

Language experience. Group experience stories are a terrific way to promote cooperation as well as the reading-writing relationship. As part of a class assignment, a reading methods student visited a classroom participating in the research project. Cindy Borthwick's fourth grade students were studying weather at the time, so she suggested that Kim Shewak guide the students in making an ABC Big Book on the weather. The class first brainstormed weather-related words, then students chose a letter and a word. Students created sentences with the selected word, proofread the sentences, copied the sentences in their page of the book, and created a picture related to their words and sentences. After mounting the pages on construction paper, the students placed them in alphabetical order to make a Big Book.

Figure 1

An example of "Summarizing Science Learning" from Kim Perdue's fourth grade

5-19-92

Big Animals 92 Africa

A large part Africa is called the plateau. Their are many different kinds of animals live an Africa. African elephants ears are bigger than their indian cousins Africa has some animals that only can survive there so when photographers come they only can just take pictures. Some people took feathers off birds so they made a law that they couldn't. Most zoos have animals from different countries. The piece of meat that is left over the volchures eat, some people call the volchures garbage eaters

A few letters stumped the fourth graders, but the final product was a delightful and informational book on the weather that they could read with their first grade "reading buddy" class. Some excerpts follow:

Aa Andrew

Hurricane Andrew struck South Florida in August 1992. Many areas in Miami were destroyed. In places like Homestead, Kendall and Cutler Ridge, people do not have homes any more.

Bb Blow

Moving air causes the blowing wind. The wind blows the clouds away. I like my hair to blow in the wind.

Just for fun. Teachers participating in the research project also enjoyed guiding students through creative writing activities. Connie Robinson's fifth grade students had fun comparing science topics to non-science ideas. When asked to compare science to a trip to the fair, one of Connie's students wrote:

I think science and the fair are simerler because they are both fun. I also think that they are both exciting and instruresting. I think science and the fair are both challengeing, and I think they can be like magic because at the fair some rides you can go up-side down and not fall out of your seat, and the science experiments can be like magic because in science no man can streach out a metal bar but tiny molecules can just by heating them.

Fourth grade teacher Laura Saef enjoyed the creative descriptions her students composed. Here is what it might feel like to be a human cell, according to one of Laura's students:

> *I am a cell. I live in the curculatory system. I am a bright red blood cell. I am very round and tiny. My job is to carry oxygen to all of your cells. I stay very busy. I travel all over the human body. Once I had a great travel. It was my favorite travel. I went to the nerve cells, to give them oxgen. It was my favorite because on my way there I past a lot of neat joints. I past a hinge joint and a ball-and-socket-joint. I liked the hinge joint because it moved around and around. I saw an immovable joint too but it was borring. My two best friends are the platelets and white blood cells. Together we work hard to help the human body live.*

Laura tied in science with Halloween by having her students dress up as either a famous scientist or piece of science equipment. Each student wrote important facts concerning their costume. Laura's students also enjoyed writing riddles:

> *Hi! I am a pretty famous person. I invented over 300 ways to use the peanut. I was an agriculture teacher in a black school in Alabama. My secretary there became vice-preisdent of the United States of America. I am a very good artist. My favorite things to draw are flowers and other natural things. I crossed almost all the states while looking for a college to go to. Who am I? George W. Carver.*

After the authors read their riddles to the class, students tried to guess "Who am I?"

Conclusion

Some essential assumptions of the whole language approach are that the language arts should be integrated, writing

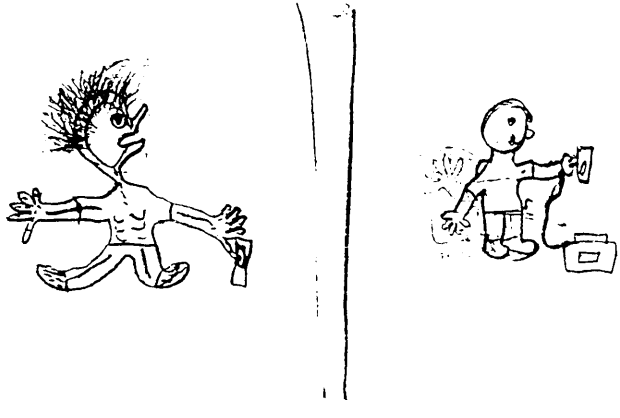
Figure 2

An example of "Applying Science to Real Life" from Kim Perdue's fourth grade

3/30/95

I'm no fool with electricity!

One way I can prevents an accident would be if thir was a lightning storm don't go under a tree go in a car or your house. Don't ever stick anything in a plug hole. If your playing with your toys turn them off when you leave or thir may be a fire. Don't ever put to many things inside a plug hole!!!!!!!! water plus electricity + you = accident.



is a central component of literacy learning, and that skills instruction should be contextually based rather than developed in isolation (Moss, 1992). The science/reading strategy implemented in this longitudinal study integrates the language arts through science as well as other content areas, emphasizes the importance of writing as a central component of literacy learning, and encourages the development of skills through content-based context instruction.

The qualitative results of this project have been very positive. The children are writing more. In turn, the children are reading more as they read their pieces to partners, peers, primary buddies, principals, and parents. The teachers in the project during the fifth year conducted more writing activities than ever before. The researchers look forward to analyzing the results both quantitatively as well as qualitatively. But perhaps a fifth grade student in Connie Robinson's class summed it up nicely when asked to write a response concerning reading through science: *Reading through science is different because when I was in fourth grade we didn't use reading, science, spelling, and language arts with science and reading. In fifth grade we use all four subjects. Yes, I would do it again next year because it was fun doing reading through science.* And so the research project continues.

References

Butzow, C.M., & Butzow, J.W. (1989). *Science through children's literature: An integrated approach.* Englewood CO: Teacher Ideas Press.

Gunning, T.G. (1992). *Creating reading instruction for all children.* Boston: Allyn and Bacon.

Langer, J.A. (1981). From theory to practice: A prereading plan. *Journal of Reading, 25,* 152-156.

Lewis, T.P. (1971). *Hill of fire.* NY: Harper Collins.

Liggett, T.C. (Project Director/Executive Producer). (1985). *Hill of fire* [videotape]. Lincoln NE: Great Plains National.

Moss, B. (1992). Whole language: The problems and promise for teacher educators. *Journal of Reading Education, 18,* 44-52.

Pearson, P.D., & Fielding, L. (1991). Comprehension instruction. In R. Barr, M.L. Kamil, P. Mosenthal, & P.D. Pearson (Eds.), *Handbook of reading research*, 815-860. NY: Longman.

Raphael, T.E. (1986). Teaching question answer relationships, revisited. *The Reading Teacher, 39*, 516-522.

Romance, N.R., & Vitale, M.R. (1992). A curriculum strategy that expands time for in-depth elementary science instruction by using science-based reading strategies: Effects of a year-long study in grade four. *Journal of Research in Science Teaching, 29*, 545-554.

Romance, N.R., Vitale, M.R., & Bristor, V.J. (March 1992). *Teaching reading through in-depth science instruction: Expansion of a curriculum integration model to at-risk students in grades 4 and 5.* Paper presented at the meeting of the National Association for Research in Science Teaching, Boston MA.

Schweiger, N. (Ed.). (1988; 1991). *Reading Rainbow: A guide for teachers.* Lincoln NE: Great Plains National.

Schweiger, N. (Ed.). (1992). *Science comes alive with Reading Rainbow.* Lincoln NE: Great Plains National.

Shymansky, J.A., Romance, N., & Yore, L.D. (1988). *Journeys in science, grade 5.* Sacramento CA: Laidlow.

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